

IN THE CLAIMS:

1 1. (Currently Amended) A method of fabricating a membrane electrode assembly
2 for use in a fuel cell, comprising:

3 (A) providing a mold that includes a first and second mold plate adapted to
4 impart a desired shape to induce compression to decrease the thickness of
5 components in the mold and to apply pressure substantially evenly across
6 an entire active area of a membrane electrode assembly being fabricated in
7 the mold;

8 (B) providing a lead frame, including at least a first lead frame component that
9 is adapted to be received into said mold;

10 (C) assembling a protonically conductive membrane with catalyst coatings on
11 each of its major surfaces onto -said first lead frame component;

12 (D) integrating the current collector into said first lead frame component onto
13 which said membrane is placed;

14 (E) placing said lead frame containing said membrane into the mold, wherein
15 the lead frame is designed to use the current collector to protect the pro-
16 tonically conductive membrane and active areas of diffusion layers of the
17 fuel cell while the molding process takes place;

18 ~~(E)~~(F) compressing said second mold plate onto said first mold plate;

19 ~~(F)~~(G) introducing a moldable material in communication with said mold plates;
20 and

21 (H) allowing the moldable material to cure in said mold to solidify and form a
22 plastic frame around said membrane to produce a membrane electrode as-
23 sembly for use in a fuel cell, wherein the plastic frame holds components
24 of the fuel cell in compression without using screws and nuts, wherein the
25 components are the protonically conductive membrane, the current collec-
26 tor, and diffusion layers of the fuel cell; and

27 | (I) trimming away exterior frame portion of the lead frame to only leave cur-
28 | rent collector portion of the lead frame.

1 2. (Cancelled) .

1 | 3. (Currently Amended) The method as defined in claim ~~2~~1 further comprising:
2 | (A) providing a second lead frame component that includes a second current
3 | collector; and
4 | (B) sandwiching said catalyzed membrane between the first and second cur-
5 | rent collectors;
6 | (C) introducing the lead frame components into said mold;
7 | (D) compressing the first and second mold plates together;
8 | (E) introducing a moldable material into said mold;
9 | (F) allowing the moldable material to cure to form the shape of the mold
10 | plates thereby forming a sealed fuel cell.

1 4. (Original) The method as defined in claim 1 wherein the step of introducing the
2 moldable material includes injection molding a moldable material into said mold.

1 5. (Cancelled)

1 6. (Currently Amended) A method of fabricating a fuel cell array, comprising:
2 | (A) providing a mold that includes a first and second mold plate of a desired
3 | shape that forms a cavity to induce compression to decrease the thickness
4 | of components in the mold and to apply pressure substantially evenly
5 | across an entire active area of a membrane electrode assembly being fabri-
6 | cated in the mold;
7 | (B) providing a sheet of protonically conductive membrane material that has
8 | been coated on each of its major surfaces with a catalyst material to form a
9 | sheet of catalyzed membrane;

- 10 (C) providing a lead frame structure that includes a plurality of individual lead
11 frame components that define separate fuel cells, wherein each lead frame
12 includes a current collector and the current collectors act as compression
13 plates within the fuel cell;
- 14 (D) assembling said sheet of catalyzed membrane into said lead frame struc-
15 ture;
- 16 (EF) placing said lead frame structure containing said membrane sheet into the
17 mold, wherein the lead frame is designed to use the current collector to
18 protect the protonically conductive membrane and active areas of diffu-
19 sion layers of the fuel cell while the molding process takes place;
- 20 (FG) compressing said second mold plate onto said first mold plate;
- 21 (GH) introducing a moldable material in communication with said mold plates;
22 ~~and~~
- 23 (HI) allowing the plastic to cure in said mold to solidify and form a plastic
24 frame around said individual fuel cells to produce a fuel cell array, wherein the
25 plastic frame holds components of the individual fuel cells in compression with-
26 out using screws and nuts, wherein the components are the catalyzed membrane,
27 the current collector, and diffusion layers of the fuel cell; and
- 28 (J) trimming away exterior frame portions of each lead frame components to
29 only leave the current collectors extending outward from the fuel cell.

1 7. (Currently Amended) A method of establishing a seal around a fuel cell, compris-
2 ing:

- 3 (A) providing a lead frame assembly including:
4 (i) providing first and second current collectors adapted to serve as lead
5 frame components in an associated mold device;
6 (ii) assembling fuel cell components including:
7 (a) a catalyzed protonically conductive, electronically non-
8 conductive membrane; and

- 9 (b) first and second diffusion layers disposed on opposite sides of
10 said membrane;
- 11 (iii) arranging said fuel cell components between said first and second cur-
12 rent collectors;
- 13 (B) inserting the resulting lead frame assembly into a molding device, wherein
14 the lead frame is designed to use the current collector to protect the protonically conduc-
15 tive membrane and active areas of the diffusion layers of the fuel cell while the molding
16 process takes place;
- 17 (C) introducing a moldable material into said molding device having a mold
18 cavity designed such so as to decrease the thickness of components in the
19 mold and to apply pressure substantially evenly across an entire active
20 area of the membrane being fabricated in the mold; ~~and~~
- 21 (D) allowing said moldable material to cure to seal the edges of the lead frame
22 assembly against leaks to thereby seal the fuel cell without using a gasket
23 and said moldable material forming a plastic frame, wherein the plastic
24 frame holds components of the fuel cell in compression without using
25 screws and nuts, , wherein the components are the catalyzed protonically
26 conductive membrane, the current collectors, and diffusion layers of the
27 fuel cell; and
- 28 (E) trimming away exterior frame portions of the lead frame components to
29 only leave the first and second current collector portions of the lead frame
30 components.

1 8. (Previously Presented) The method as defined in claim 7 further comprising spot
2 welding the first and second current collectors that serve as lead frame components to-
3 gether to maintain the components in place.

1 9. (Cancelled)

1 10. (Previously Presented) The method as defined in claim 7 further comprising pro-
2 viding said mold device with a mold cavity which, when said moldable material is intro-
3 duced into said mold cavity and cured, creates a frame around said fuel cell.

1 11. (Currently Amended) A method of establishing a sealed diffusion layer for use in
2 a fuel cell, comprising:

- 3 | (A) providing a first current collector integrated into a first lead frame compo-
4 | nent, wherein the first current collector includes a raised surface;
- 5 (B) applying a diffusion layer material to said first current collector on
6 | said first lead frame component;
- 7 | (C) providing a second current collector integrated into a second lead frame
8 | component;
- 9 (D) applying a second diffusion layer material to said second current collector
10 | on said second lead frame component;
- 11 (E) placing a catalyzed protonically conductive, electronically non-conductive
12 membrane between said first lead frame component and said second lead
13 frame component to form an assembly, wherein the lead frame is designed
14 to use the current collector to protect the protonically conductive mem-
15 brane and active areas of the diffusion layers of the fuel cell while the
16 molding process takes place;
- 17 (F) placing said assembly into a molding device;
- 18 (G) closing mold plates associated with said molding device and hot pressing
19 the assembly for a predetermined time period to decrease the thickness of
20 components in the mold and to apply pressure substantially evenly across
21 an entire active area of a membrane electrode assembly being fabricated in
22 the mold;
- 23 (H) introducing a moldable material into said mold cavity of said mold device;
24 and
- 25 (I) allowing said moldable material to cure to seal said lead frame compo-
26 nents integrating said first and second current collectors together to form a

27 fuel cell, wherein said moldable material forms a plastic frame and the
28 plastic frame holds components of the fuel cell in compression without us-
29 ing screws and nuts, wherein the components of each fuel cell are the cata-
30 lyzed protonically conductive membrane, the current collectors, and diffu-
31 sion layers of the fuel cell; and

32 (J) trimming away exterior frame portions of the first and second lead frame
33 to only leave the first and second current collectors extending outward
34 from the fuel cell,-

1 12. (Original) The method as defined in claim 11 wherein step (H) includes an insert
2 molding technique.

1 13. (Previously Presented) The method as defined in claim 11 further comprising
2 spot welding said first and second lead frame components together to maintain said com-
3 ponents in position prior to placing the assembly into the molding device.

1 14. (Currently Amended) A method of introducing compression into a fuel cell, com-
2 prising:

- 3 (A) providing a catalyst coated membrane;
- 4 (B) providing a first current collector integrated into a first lead frame compo-
5 nent suitable for being received into a molding device;
- 6 (C) providing a second current collector integrated into a second lead frame
7 component suitable for being received into a molding device;
- 8 (D) assembling said first and second current collectors on either side of said
9 membrane to result in an assembly;
- 10 (E) placing said assembly into said mold device that has been provided with
11 mold plates that form a cavity that induces compression to decrease the
12 thickness of components in the mold and to apply pressure substantially
13 evenly across an entire active area of a membrane electrode assembly be-
14 ing fabricated in the mold, wherein the lead frame is designed to use the

- 15 | current collector to protect the protonically conductive membrane and ac-
16 | tive areas of diffusion layers of the fuel cell while the molding process
17 | takes place;
18 | (F) closing said mold plates and maintaining said mold plates in a closed posi-
19 | tion to induce further compression;~~and~~
20 | (G) introducing a moldable material into the resulting mold cavity thereby cre-
21 | ating a plastic frame around the fuel cell that maintains compression
22 | within said fuel cell without the need for mechanical fasteners, wherein
23 | the components are the catalyzed coated membrane, the current collectors,
24 | and diffusion layers of the fuel cell; and
25 | (H) trimming away exterior frame portions of the first and second lead frame
26 | components to only leave the first and second current collector portions of
27 | the lead frame components.

1 15. – 21. (Cancelled)

1 22. (Currently Amended) A method of fabricating a membrane electrode assembly for
2 use in a fuel cell, comprising:

3 providing the membrane electrode assembly having a proton exchange membrane,
4 wherein the proton exchange membrane is configured with an anode aspect and a cathode
5 aspect;

6 providing an anode side component of a lead frame, with the anode side compo-
7 nent of the lead frame having an anode current collector;

8 providing a cathode side component of the lead frame, with the cathode side com-
9 ponent of the lead frame having a cathode current collector;

10 connecting the anode side component of the lead frame to the cathode side com-
11 ponent of the lead frame with the membrane electrode assembly sandwiched between to
12 form a lead frame assembly;

13 placing the lead frame assembly within a mold cavity, wherein the lead frame is
14 designed to use the current collector to protect the protonically conductive membrane and
15 active areas of diffusion layers of the fuel cell while the molding process takes place;

16 closing the mold cavity, wherein the fuel cell is compressed to a predetermined
17 thickness dictated by a desired internal pressure; and

18 injecting plastic around the membrane electrode assembly to form a plastic frame,
19 where in the plastic frame holds components of the fuel cell in compression without using
20 screws and nuts, wherein the components are the membrane electrode assembly, the cur-
21 rent collectors, and diffusion layers of the fuel cell; and

22 trimming away exterior frame portions of the lead frame component to only leave
23 the anode and cathode current collector extending outward from the fuel cell.

1 23. (Cancelled)

1 24. (Currently Amended) The method of claim 22, further comprising:

2 providing one or more anode diffusion layers between the anode current collector
3 and the anode aspect, wherein the one or more anode diffusion layers are employed to

4 evenly distribute a liquid fuel mixture across the anode aspect of the proton exchange
5 membrane; and

6 providing one or more cathode diffusion layers between the cathode current col-
7 | lector and the cathode aspect, wherein the one or more cathode diffusion layers allows a
8 | fast supply and even distribution of gaseous oxygen across the cathode aspect of the pro-
9 | ton exchange membrane.

1 25. (Previously Presented) The method of claim 22, wherein the anode current collector,
2 the cathode current collector, and the proton exchange membrane are each configured
3 with a plurality of openings that allow plastic to flow through to form a plurality of inter-
4 nal fasteners.